

CLAIMS

- 1 1. A waveguide-semiconductor coupling device comprising:
2 a waveguide structure that includes a multimode interferometer (MMI) structure
3 so as to minimize the reflections of TE modes in said coupling device; and
4 a mesa structure that is coupled to said waveguide structure so as to minimize the
5 reflections of TM modes in said coupling device.
- 1 2. The waveguide-semiconductor coupling device of claim 1, wherein said mesa
2 structure comprises Ge.
- 1 3. The waveguide-semiconductor coupling device of claim 2, wherein said mesa is
2 coupled to a detector.
- 1 4. The waveguide-semiconductor coupling device of claim 3, wherein said detector
2 comprises Ge.
- 1 5. The waveguide-semiconductor coupling device of claim 1, wherein said waveguide
2 structure includes a polarization rotator.
- 1 6. The waveguide-semiconductor coupling device of claim 1, wherein said mesa
2 structure is tapered.
- 1 7. The waveguide-semiconductor coupling device of claim 3, wherein said waveguide
2 structure and said mesa structure are coupled at Brewster angles of the TM modes.

1 8. The waveguide-semiconductor coupling device of claim 7, where said Brewster angles
2 are defined as $\tan^{-1}(n_D/n_{WG})$, where n_D is the index of refraction of the Ge detector and
3 n_{WG} is the index of the waveguide structure.

1 9. A method of forming a waveguide-semiconductor coupling device comprising:
2 forming a waveguide structure that includes a multimode interferometer (MMI)
3 structure so as to minimize the reflections of TE modes in said coupling device; and
4 forming a mesa structure that is coupled to said waveguide structure so as to
5 minimize the reflections of TM modes in said coupling device.

1 10. The method of claim 9, wherein said mesa structure comprises Ge.

1 11. The method of claim 10, wherein said mesa is coupled to a detector.

1 12. The method of claim 11, wherein said detector comprises Ge.

1 13. The method of claim 9, wherein said waveguide structure includes a polarization
2 rotator.

1 14. The method of claim 9, wherein said mesa structure is tapered.

1 15. The method of claim 11, wherein said waveguide structure and said mesa structure
2 are coupled at Brewster angles of the TM modes.

1 16. The method of claim 15, where said Brewster angles are defined as $\tan^{-1}(n_D/n_{WG})$,
2 where n_D is the index of refraction of the Ge detector and n_{WG} is the index of the
3 waveguide structure.